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Pesticide Fact Sheet Number 24: Carbofuran

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16. Abstract (Limit: 200 words)

This document contains up-to-date chemical information, including a summary of the Agency's regulatory position and rationale, on a specific pesticide or group of pesticides. A Fact Sheet is issued after one of the following actions has occurred.

1. Issuance or reissuance of a registration standard,
2. Issuance of each special review document,
3. Registration of a significantly changed use pattern,
4. Registration of a new chemical, or
5. An immediate need for information to resolve controversial issues relating to a specific chemical or use pattern.

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Pesticides, regulations, Chemical Information Fact Sheet, Use Patterns, Science Findings

b. Identifiers/Open-Ended Terms

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Office of Pesticide Programs (TS-768C)
Washington, DC 20460

EPA

Pesticide Fact Sheet

Name of Chemical: Carbofuran
Reason for Issuance: Registration Standard
Date Issued: June 25, 1984
Fact Sheet Number: 24

1. Description of Chemical

Generic name: 2,3-dihydro-2,2-dimethyl-7-benzofuranyl methylcarbamate
Common name: carbofuran
Trade Names and code numbers: Furadan, Curaterr, Yaltox, Bay 78537, D 1221 ENT 27164, FMC 10242, and NIA 10242
EPA Shaughnessy code: 090601
Chemical Abstract Service (CAS) number: 1563-66-2
Year of initial registration: 1969
Pesticide type: insecticide, nematicide
Chemical family: carbamate
U. S. producer: FMC Corporation

2. Use Patterns and formulations

Application sites: Fruit and field crops, vegetables, tobacco, ornamentals and forest trees

Types and methods of applications: aerial and ground application as a granular or spray

Application rates: 0.5 to 10 lbs a.i./acre

Usual carriers: (Confidential Business Information)

3. Science Findings:

Summary:

Chemical Characteristics:

Technical carbofuran is a white crystalline solid with a melting point of 153 - 154°C and a vapor pressure of 2×10^{-5} mm Hg at 33°C. The empirical formula is $C_{12}H_{15}NO_3$ and the molecular weight is 221.3. Solubility in water is 700 ppm. Other solubilities include 30% in N-methyl-2-pyrrolidone, 25% in dimethyl sulfoxide, 15% in acetone, 14% in acetonitrile, 12% in methylene chloride, 9% in cyclohexanone, and 4% in benzene.

Toxicological characteristics:

Current available acute toxicological studies on carbofuran show the following:

- Acute oral toxicity: rat, LD_{50} 3.8-34.5 mg/kg; mouse, LD_{50} 14.4 mg/kg cat, 2.5 - 3.5 mg/kg; dog, LD_{50} 15-18.9 mg/kg (Tox Category I)

- Acute dermal toxicity: rabbit, LD_{50} in isopropanol <46.4; LD_{50} in water >10,250; 75WP formulation LD_{50} in water, 3400 (Toxicity Category I)

- Acute inhalation: (dust) rat. 1hr. LD_{50} 0.80 - 0.108 mg/L; rat 4 hr. LD_{50} 0.075-0.108 mg/L; rat. 1hr. LD_{50} >0.026 mg/L; rat, LC_{50} 4 hr. 0.017 - 0.047 mg/L (Toxicity Category I)

- Primary eye irritation and primary dermal irritation not done since this is a category I material precluding condition of meaningful studies. (Assumed to be Toxicity Category I)

Major routes of exposure: Application by ground and aerial spray equipment increases the potential for exposure of humans, livestock, and wildlife due to spray drift. Human exposure to carbofuran from handling, application, and reentry operations would be minimized by the use of approved respirators and other protective clothing.

Physiological and Biochemical characteristics

Mechanism of pesticidal action: Cholinesterase inhibition following contact with treated surfaces or soil and/or ingestion of treated plant tissue.

Metabolism in plants and animals is similar, carbofuran● is systemic in plants. Like other carbamates, metabolized rapidly in animals into less toxic and finally non-toxic metabolites.

Environmental Characteristics

Carbofuran degrades fairly slowly in non-sterile, neutral or acid aerobic soils with half-lives ranging from 1-8 weeks. It is more stable in sterile soil and unstable under alkaline conditions. Under anaerobic conditions carbofuran is more stable and may take twice as long to degrade. The major degradates of concern are the 3-hydroxy carbamate and 7-phenol products resulting from hydrolysis. The metabolites of carbofuran are less toxic than the parent compound.

Carbofuran is mobile in soil, particularly sandy soil with high percolation rate. It has been found in shallow aquifers under or near treated fields in three states at levels up to 50ppb.

Ecological Characteristics

Acute avian oral toxicity; LD_{50} 90-5 mg/kg
Avian subacute dietary toxicity; LD_{50} 16-1104 ppm
Freshwater fish acute toxicity; LC_{50} 94-2859 ppb
Acute toxicity for freshwater invertebrates; 9.8-38.6 ppb

Based on studies available to assess hazards to wildlife and aquatic organisms carbofuran is characterized as very highly toxic to cold water and warm water fish, highly toxic to freshwater invertebrates and very highly toxic to birds. Label precautions reduce the hazard to wildlife and aquatic organisms.

Monitoring studies are being required to allow a better assessment of the actual effects of carbofuran use on non-target organisms under field conditions. Primary emphasis will be on effects of use of carbofuran on bird populations.

Efficacy Review Results: none conducted.

Tolerance Assessment:

The previously established tolerances for residues of carbofuran and its cholinesterase - inhibiting metabolites are published in 40 CFR 180.254, 21 CFR 193.43, and 21 CFR 561.67. A summary of these tolerances follows:

U. S. Tolerances	Maximum Residue Limits (PPM)	
Crop	Carbamate	Total
alfalfa forage	5.0	10.0
alfalfa hay	20.0	40.0
bananas	-	0.1
barley, grain	0.1	0.2
barley, straw	1.0	5.0
cattle, (fat, meat, and meat byproducts)	0.02	0.05
coffee beans	-	0.1
corn, field and popcorn-grain	0.1	0.2
corn, fresh-kernels and cob (husk removed)	0.2	1.0
corn fodder and forage, field, pop-, and sweet	5.0	25.0
cottonseed	0.2	1.0
cranberries	0.3	0.5

U. S. Tolerances (continued)	Maximum Residue Limits (PPM)	
Crop	Carbamate	Total
cucumbers	0.2	0.4
goats, (fat, meat, and meat byproducts)	0.02	0.05
grapes	0.2	0.4
grapes, dried pomace	1.5	2.0
hogs (fat, meat, and meat byproducts)	0.02	0.05
horses, (fat, meat, and meat byproducts)	0.02	0.05
melons	0.2	0.4
milk	0.02	0.1
oats, grain	0.1	0.2
oats, straw	1.0	5.0
peanuts	1.5	4.0
peanut hulls	8.0	10.0
peanut soapstock	3.0	24.0
peppers	0.2	1.0
potatoes	1.0	2.0
pumpkins	0.6	0.8
raisins	1.0	2.0
raisin waste	3.0	6.0
rice, grain	-	0.2
rice, straw	0.2	1.0
sheep, (fat, meat, and meat byproducts)	0.02	0.05
sorghum, (grain)	-	0.1
sorghum, (grain), forage & fodder	0.5	3.0
soybeans	0.2	1.0
soybean, forage and hay	20.0	35.0
soybean, soapstock	1.0	6.0
squash	0.6	0.8
strawberries	0.2	0.5
sugar beets	-	0.1
sugar beet tops	1.0	2.0
sugarcane	-	0.1
sunflower	0.4	0.8
sunflower seed hulls and meal	0.5	1.0
sweet potato	0.6*	2.0*
tobacco	N/A	N/A
wheat, grain	0.1	0.2
wheat, straw	1.0	5.0

*Proposed
N/A not applicable - nonfood use

The data for carbofuran residues in or on the following agricultural commodities are adequate to fill the residue data requirements: sugar beet tops, soybean, soybean soapstock, soybean forage and hay, cucumbers, melons, pumpkins, squash, cranberries, raisins, strawberries, barley grain, oat grain, wheat grain, barley straw, oat straw, wheat straw, cottonseed, peanuts, the fat, meat and meat-by-products' of cattle, goats, hogs, horses, and sheep, milk, poultry, and eggs. However, although additional data are not required to to support the tolerances for milk, peanuts, peanut hulls, and fatty acids of peanut soapstock, the tolerances for these agricultural commodities must be changed as follows:

Commodity	Present Tolerance		Change Tolerance To	
	Carbamate	Total	Carbamate	Total
milk	0.02 ppm	0.1 ppm	0.05 ppm	0.2 ppm
peanuts	1.5 ppm	5.0 ppm	0.2 ppm	0.6 ppm
peanut hulls	8.0 ppm	10.0 ppm	0.3 ppm	1.5 ppm
peanut soapstone	3.0 ppm	24.0 ppm	1.0 ppm	6.0 ppm

Additional residue data are required for the following commodities (and their processed products, if applicable): potato, sugar beets, peppers, grapes (including dried pomace and raisin waste), corn (grain, forage and fodder), rice (grain and straw), sorghum (grain, forage and fodder), alfalfa forage and hay, bananas, coffee, sugarcane and tobacco. No crop groupings can be established at this time because of residue chemistry data gaps. Compatability between Codex MRLs and U.S. tolerances will be assessed when data have been submitted and evaluated.

The previously established Acceptable Daily Intake (ADI) for carbofuran is 0.005 mg/kg/day and the Theoretical maximum Residue Concentration (TMRC), based on the established tolerances for residues of carbofuran as cited under 40 CFR 180.254, is 0.3415 mg/day for a 1.5 kg food diet for a 60 KG person. The TMRC is 113.84% of the ADI. Actual concentrations of carbofuran are likely to be substantially lower than the ADI since the 113% calculation assumes 100% of all crops on the label were treated.

4. Summary of Regulatory Position and Rationale

Use classification: Restricted
(This and other label revisions to appear on all products released for shipment after September 1, 1985 and on all products in channels of trade after September 1, 1986)

Use restrictions: Do not use on Long Island, New York

Unique warning statement required on labels: Labels for all manufacturing use products (MPs) containing carbofuran must bear statements reflecting the hazards to man and the environment [40 CFR 162.10]. Carbofuran is in Toxicity Category I on the basis of acute toxic effects.

- Based on the data reviewed by the Agency, the environmental hazards statement below is required to appear on all MPs containing Carbofuran.

"This pesticide is toxic to fish, birds and other wildlife. Do not discharge into lakes, streams, ponds, estuaries, oceans or public water unless this product is specifically identified and addressed in an NPDES permit. Do not discharge effluent containing this product to sewer systems without previously notifying the sewage treatment plant authority. For guidance, contact your State Water Board or Regional Office of the Environmental Protection Agency.

Labels for all end-use products (EPs) containing carbofuran must bear a statement reflecting the hazard to man and the environment [40 CFR 162.10]

"Restricted Use Pesticides"

"For retail sale to and use only by certified applicators or persons under their direct supervision and only for those uses covered by the certified applicator's certification."

The "Directions for Use" section of the label must include the following statements:

Georgaphical Use Restrictions:

"Do not use this product on Long Island, N. Y."

Rotational Crops:

"Do not plant any crop other than those with registered carbofuran uses in carbofuran-treated soil sooner than 18 months after last application"

Reentry:

"If prolonged intimate contact with corn and/or sorghum foliage will result, do not re-enter treated fields within 14 days of application without wearing proper protective clothing. For all other situations, do not re-enter fields less than 24 hours following application."

- Based on data reviewed by the Agency, the following human and environmental hazards statements are required to appear on the EP products.

The following precautions must be included in the "Hazards to humans and Domestic Animals" section of the product label:

"Poisonous if swallowed. May be fatal or harmful as a result of skin or eye contact or by breathing dust. Causes cholinesterase inhibition. Warning symptoms of poisoning include weakness, headache, sweating, nausea, vomiting, diarrhea, tightness in chest, blurred vision, pinpoint eye pupils, abnormal flow of saliva, abdominal cramps, and unconsciousness. Atropine sulfate is antidotal."

"In case of skin contact, wash skin immediately with soap and water. Remove contaminated clothing and wash before reuse. In case of swallowing, drink 1 or 2 glasses of water and induce vomiting by touching back of throat with finger. Do not induce vomiting or give anything by mouth to an unconscious person."

"Wear long-sleeved clothing and protective gloves when handling. Wash hands and face before eating or smoking. Bathe at the end of the work day. Change clothing daily and wash before reuse.

The following statements must appear under the heading "Environmental Hazards."

i. "Carbofuran is known to leach through soil, and has been found in groundwater as a result of agricultural use. Users are advised not to apply in areas where soils are permeable, i. e., well drained, and which overlie shallow aquifers, particularly those currently being used for drinking water. Consult with the pesticide state lead agency for information regarding soil permeability and aquifer locations

ii. Granular products except for use on rice: "This product is toxic to fish, birds and other wildlife. Birds feeding on treated areas may be killed. Cover or incorporate granules in spill areas. Runoff from treated areas may be hazardous to fish in neighboring areas. Do not apply directly to water or wetlands. Do not contaminate wells, wetlands or any body of water by cleaning of equipment or disposal of waste."

iii. Granular products used on rice:
Same as for the granular products except delete "Do not apply directly to water" and substitute "Fish may be killed at recommend rates."

iv. Non-granular products:
"This product is toxic to fish, birds and other wildlife. Birds feeding on treated areas may be killed. Drift and runoff from treated areas may be hazardous to fish in neighboring areas. Do not apply directly to water. This pesticide is highly toxic to bees exposed to direct treatment or residues on crops. Do not apply this product or allow it to drift to blooming crops or weeds if bees are visiting the treatment area."

v. Non-granular products used on potatoes and/or alfalfa:
"For waterfowl protection, do not apply immediately before or during irrigation, or on fields in proximity of waterfowl nesting areas, or on fields where waterfowl are known to repeatedly feed."

5. Summary of Major Data Gaps

Product Chemistry: Data on product formation of ingredients, preliminary analysis and certification of limits are the major product chemistry gaps.

Residue Chemistry: Additional data are required to support the tolerances for a variety of crops. Residue chemistry data requirements are outlined in detail in the tolerance assessment in Section 3 of this Fact Sheet.

Wildlife and aquatic organisms: The primary concern is monitoring bird populations following commercial application to determine extent of adverse effects, particularly on songbirds and raptors.

Environmental Fate: In addition to regular environmental chemistry requirements, monitoring studies are needed to find the extent and level of groundwater contamination and the conditions under which groundwater contamination occurs.

All data must be submitted no later than June 1987. Interim reports on groundwater and avian monitoring must be submitted at the end of each season.

6. Contact person at EPA

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